



# Coastal Geomorphology Monitoring Program Summary

## Network Parks Where Monitoring Occurs

Gulf Islands National Seashore (GUIS) and Padre Island National Seashore (PAIS).

## Importance

Geomorphology is the study of change in earth’s landforms caused by things such as weather, geologic processes, or human activities. Landform is the physical foundation for ecosystems and natural resources, and barrier islands are more likely to be affected by things such as climate change, hurricanes and other extreme weather events, sea-level change, and human development. For these reasons, coastal geomorphology is ranked as one of the top vital signs for monitoring in the Gulf Coast Network Vital Signs Monitoring Plan.

Changes in coastal geomorphology are caused by erosion or accretion and vary both spatially and temporally. Understanding the variations is key to early recognition of potential issues affecting natural and cultural resources in coastal parks. The Gulf Coast Network (GULN) has modeled two protocols for monitoring coastal geomorphology on methods established by the Northeast Coastal and Barrier Network (NCBN). GULN surveys both ‘coastal topography’, or the beach/dune elevation profile, and shoreline position using GPS equipment. Surveys occur in the spring of every other year in each of the two national seashores in the network.

## Monitoring Objectives

The objective is to identify the biennial and long-term trends and variability in time and space of beach/dune morphology and shoreline position in network parks. The specific monitoring questions are:

- 1. What are the current dimensions of the coastal features?
- 2. What are the long-term, ten years or more, displacement dimensions and direction of the coastal features?
- 3. What are the spatial and temporal trends in the displacement of the coastal features?



Crew member walking the high tide swash line with a handheld GPS to collect data for the shoreline position protocol.

## Basic Approach

For the coastal topography protocol, the network established a framework of equally spaced cross-shore transects in a Geographic Information System (GIS) along the entire shorelines of PAIS and GUIS (see maps on back). From this framework, a set of monitoring sites was selected to support high-priority park resource management decisions and other GULN vital signs monitoring projects. To collect monitoring data, a crew member records elevations on precision GPS equipment at the topographic inflections in the beach and primary dune complex along the transect.

For the shoreline position protocol, a crew member walks or drives the high tide swash line during a neap tide period with a handheld or utility task vehicle (UTV)-mounted GPS unit. A wet/dry line in the sand, shell hash or other debris generally marks the swash line.

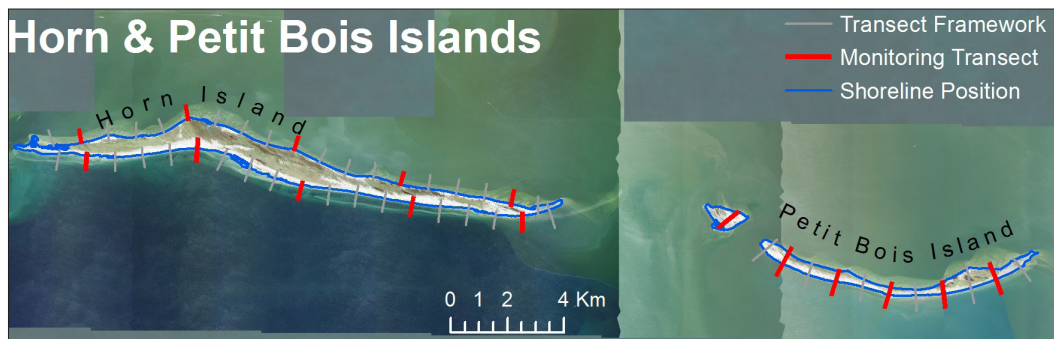
## Samples Sizes, Frequency and Target Areas

| Park | Approx. Dist. of Monitored Shoreline | Number of Topographic Transects | Start Year/ Frequency  | Management Area/GULN Monitoring                             |
|------|--------------------------------------|---------------------------------|------------------------|-------------------------------------------------------------|
| PAIS | 105 km                               | 23                              | 2017/ Every other year | Closed Beach, Port Mansfield Channel/GULN Vital Sign Panels |
| GUIS | 101 km                               | 32                              | 2018/ Every other year | Pensacola Pass, Petit Bois Island, Horn Island              |



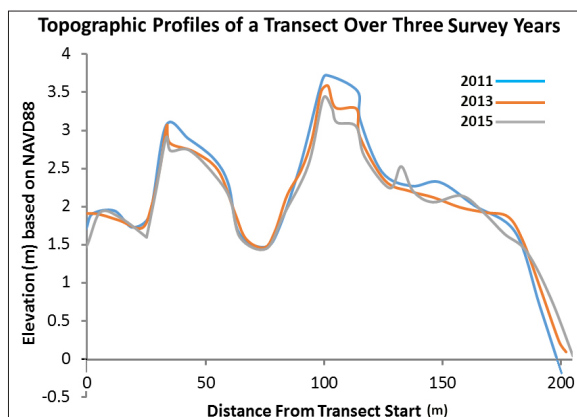
Crew member recording elevations at Padre Island NS with precision GPS equipment for the coastal topography protocol.

## Horn & Petit Bois Islands

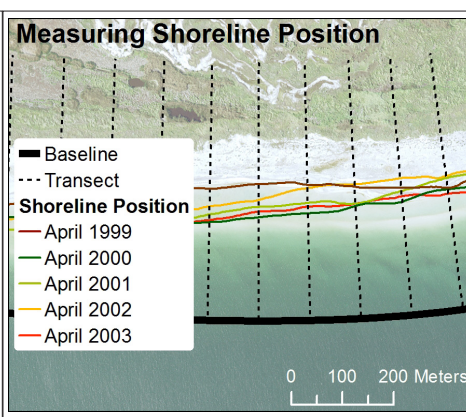


## Data Analysis and Reporting

Elevations from transect surveys are transformed into cross-sectional profiles for measurement and comparison (below, left). Key measurements include – (1) Area above North American Vertical Datum of 1988 (NAVD88), (2) Distance from transect origin to foredune crest and to 0.0m NAVD88, and (3) Foredune crest height. These measurements are compared across time to report on morphological variation and long-term stability. Shoreline position is a distance along virtual transects from a baseline to the intersection with a surveyed shoreline (below, right). The changes in distance across time are reported on to assess relative stability of the shoreline position, an indicator of overall morphological system stability.



Example figure of a coastal topography transect measured in three different biennial surveys, with each year represented as a recorded during shoreline monitoring in five different colored line. The transects in this figure are not related to the transects for coastal topography.



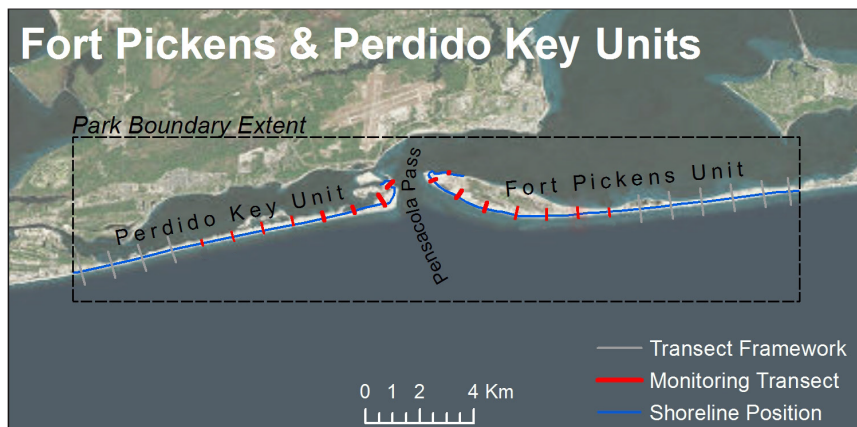
## About the Gulf Coast Network

In 1999, the National Park Service initiated a long-term ecological monitoring program, known as “Vital Signs Monitoring,” to provide the minimum infrastructure to allow more than 270 national park system units to identify and implement long-term monitoring of their highest-priority measurements of resource condition. The overarching purpose of natural resource monitoring in parks is to develop scientifically sound information on the current status and long-term trends in the composition, structure, and function of park ecosystems, and to determine how well current management practices are sustaining those ecosystems.

Five goals are addressed for all parks with significant natural resources:

1. Determine the status and trends in selected indicators of the condition of park ecosystems,
2. Provide early warning of abnormal conditions,
3. Provide data to better understand the dynamic nature and condition of park ecosystems,

## Fort Pickens & Perdido Key Units



4. Provide data to meet certain legal and congressional mandates, and
5. Provide a means of measuring progress towards performance goals.

### For more information

GULN home page:  
<https://www.nps.gov/im/guln/index.htm>

NPS Inventory & Monitoring Division:  
<https://www.nps.gov/im/index.htm>